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IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF WYOMING

ESTATE OF DAVID RANDALL WILLIAMS, M.D., et al., Plaintiffs, vs. VAIL RESORTS DEVELOPMENT COMPANY, a Colorado corporation, et al., Defendants and Third Party Defendants.	02-CV-17J
JOETTE WILLIAMS, Plaintiff, vs. VAIL RESORTS DEVELOPMENT COMPANY, a Colorado corporation, et al., Defendants and Third Party Defendants.	02-CV-16J PLAINTIFFS' SUPPLEMENTAL DESIGNATION OF EXPERT WITNESS: JOHN M. HOFFMANN, PH.D., C.S.P., P.E.

Plaintiffs supplement their previous expert witness designation regarding Dr. John M. Hoffmann, Ph.D. as follows:

- Dr. Hoffmann has prepared a supplemental report dated September 8, 2003. The supplemental report is attached hereto as Exhibit A.

- Dr. Hoffmann has prepared videotapes of the computer reconstruction as well as the boiler room reconstruction, which are discussed in his supplemental report. A copy of both videotapes is being provided to defense counsel.

DATED this 10th day of September, 2003.

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CERTIFICATE OF SERVICE

I hereby certify that on this 10th day of September, 2003, a true and correct copy of **PLAINTIFFS' SUPPLEMENTAL DESIGNATION OF EXPERT WITNESS: JOHN M. HOFFMANN, Ph.D.** was served upon the persons named below, at the addresses set below their name, in the manner indicated.

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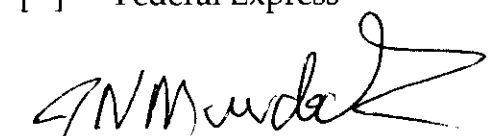

MURDOCK LAW FIRM, LLC

SAFETY ENGINEERING LABORATORIES, INC.

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF WYOMING
CIVIL NO. 02-CV-17-125

Estate of
DAVID RANDALL WILLIAMS, M.D., et al.
vs.
VAIL RESORTS DEVELOPMENT COMPANY, et al.

SUPPLEMENTAL REPORT
SEPTEMBER 8, 2003

Prepared by: _____
John M. Hoffmann, Ph.D., C.S.P., P.E.

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Estate of
DAVID RANDALL WILLIAMS, M.D., et al.
vs.
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SUPPLEMENTAL REPORT
SEPTEMBER 8, 2003

TABLE OF CONTENTS

The purpose of this report is to supplement the original report filed on June 30, 2003 with results from work that was in progress at that time. None of the information in this report alters or changes the basic opinions rendered previously. However, the tests and demonstrations described herein: provide additional bases for those opinions; are illustrative of the physical conditions surrounding the circumstances of Dr. Williams death and Mrs. Williams injuries; and clearly demonstrate the manner in which carbon monoxide (CO) was introduced into the Building C laundry room and Building C room 327. There are two parts to this report, exemplar room tests and demonstrations and accident reconstruction animation.

EXEMPLAR LAUNDRY ROOM TESTING

The Vail employees who worked in or periodically entered the laundry room complained of typical symptoms of carbon monoxide poisoning starting in January/February 2001. Carbon monoxide detectors used in the laundry room starting in February 2001 measured significant levels of CO in the laundry room. These levels exceeded the maximum levels permitted in the work place both for short time exposures and eight hour work day time weighted averages, periodically from February 2001 up to and including August 1, 2001. Vail management was aware of these grossly hazardous conditions yet failed to take any steps to reduce the hazards to employees and guests.

Measurement of CO levels taken on the day of the accident by the Fire Marshal and by investigators on August 28, 2001, clearly showed the very high levels of CO (approximately 70,000 ppm or seven percent) in the combustion exhaust gases from the Mighty Max boiler.[1] Additional measurements showed the presence of CO in the area of the exterior of the laundry room in Building C. Lint from the laundry room dryer exhausts was present on surfaces on the outside of the building,

[1] *Measurements taken of the CO concentration on August 28, the inspection of the boiler diffuser and other combustion gas train components on October 1, 2001 and the analysis provided in the report dated June 30, 2003, clearly show the Mighty Max to be the principal source of CO outside of the laundry room. Further, the use of a jumper to bypass a safety switch whose primary purpose is to prevent incomplete combustion was the reason that the boiler continued to operate, producing large quantities of CO when it otherwise would have shut down.*

as well as on the vent and intake of the Mighty Max boiler and the draft inducer vents for the laundry room water heaters. There were also accumulations of lint on surfaces around the exterior of the HVAC unit and window of Room 327. Carbon monoxide levels in Room 327 exceeded 150 ppm during the brief period of time that the Mighty Max boiler was operated on August 28, 2001.

To demonstrate the entry mechanism of carbon monoxide from the outside on the east side of the laundry room into the laundry room, an exemplar facility was constructed. This exemplar was built inside an existing 40' x 60' x 16' metal building with a concrete floor at SEL's large test facility in Yale, Michigan. The exemplar was constructed using wood framing and gypsum board construction. The exterior was covered with 4 MIL plastic and the floor plates sealed to the concrete floor to more nearly represent the masonry walls (in terms of breathing or air migration) of the actual Building C laundry room. Prehung metal doors on metal jambs were used for the interior and exterior doors of the laundry room similar to those in Building C. The laundry room dryers were simulated using a fan capable of exhausting more than 5000 CFM. This exhaust fan was connected to two exhaust ducts of the same size and configuration as the actual dryer exhausts. Restriction of the fan intake was used to vary the exhaust volume. The exhaust volume in each of the twelve inch ducts was measured using a calibrated anemometer.

Draft inducers for the laundry room water heaters and the associated exhaust ducting from the draft inducers were the same as those used in the Building C laundry room. The actual water heaters were simulated with solid cylindrical shapes since the water heaters themselves did not affect the flow of air into or out of the laundry room even when they were operating. A Mighty Max boiler was not installed since its closed intake of combustion air and exhaust system had no effect on the movement of air into or out of the laundry room. A mock Mighty Max boiler was in place for illustrative purposes.

Four basic demonstrations were conducted using three different exhaust air flows from the simulated dryer exhaust system. In the "A" series tests the exhaust volume in each dryer exhaust

duct was approximately 1250 CFM for a total of 2500 CFM.[2] In the B series of tests the dryer exhaust volume was reduced to approximately 900 CFM or a total of 1800 CFM exhausted from the laundry room. In the C series of tests the dryer exhaust volume was reduced to 700 CFM or a total of 1900 CFM. Smoke candles were used to visually show the flow of air from outside of the laundry room to the inside and to demonstrate the positive flow from the draft diverters on the water heaters when the draft inducers were operating.

In Test 1A (dryer exhaust 1250 CFM), Test 1B (dryer exhaust 900 CFM) and Test 1C (dryer exhaust 700 CFM) smoke was generated in the area near the draft inducer exterior vents. Inside, smoke was observed flowing into the laundry room from the draft diverters on top of each simulated water heater. In Test 2A (1250 CFM), 2B (900 CFM) and Test 2C smoke was generated near the exterior vents as in Tests 1A, B & C, the draft inducers were operating and no smoke was observed being drawn into the laundry room through the water heater vents.

In Test 3A (1250 CFM), 3B (900 CFM) and 3C (700 CFM) small smoke candles were held near the top of the simulated water heaters below the outer edge of the draft diverter. Smoke from these candles spread into the room until the draft inducer fans were turned on. The candle smoke was then drawn into the draft diverter from candle positions near the edge of the draft diverters. In Test 4A (1250 CFM), 4B (900 CFM) and 4C (700 CFM) smoke candles were held near each exterior door (except for the hall door near the washing machines) while the draft inducer fans were off. Smoke was drawn into the laundry room through cracks and spaces around each of the doors.

These tests clearly demonstrate the well known effects of the operation of exhausting gas burning appliances that used air for combustion taken from a confined space in which they are located. The mechanically exhausted air from the dryers and draft inducers must be replaced. Unless specific provisions are made to supply adequate make up air to replace that which is

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[2]*The dryer manufacturer recommends 2450 CFM for optimum operation of each dryer, a total of 4900 CFM would be the volume of air required with both dryers operating. "CFM" is cubic feet per minute.*

exhausted, air will enter from any source outside of the room. Air from the outside is drawn[3] in through any crack, crevice or opening bringing with it whatever is contained in the air. In the case of Vail's Building C laundry room high concentrations of carbon monoxide were introduced into the room in just this manner. Appendix A contains the conditions for each of the tests noted above, the results and a videotape of the visual effects with smoke. Photographs of the exemplar under construction and of the finished room are contained in Appendix A.

ACCIDENT RECONSTRUCTION ANIMATION

A video recreation of the conditions at Building C was prepared using dimensionally correct rooms, equipment, vents and furnishings (Appendix B). The purpose of this video is to assist people in understanding the flow and movement of carbon monoxide from the Mighty Max boiler around the outside of Building C and back into the laundry room and into Room 327. It is also illustrative of the role of all the exterior vents from the laundry room in this accident. The video shows the movement of lint laden exhaust air from the dryers into and past the air inlet to the Mighty Max boiler and extending along the exterior of the laundry room. The colorless carbon monoxide is depicted in the video as a blue smoke and is shown being drawn into Room 327 through the fresh air vent of the HVAC as well movement past the draft inducer vents. The depictions of the movement of CO from the Mighty Max vent as shown in this recreation are correct to a reasonable degree of engineering and scientific certainty.

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[3] *In actuality the removal of air through a gas burning appliance, such as a dryer or conventional water heater, creates a lower static air pressure in the confined space. Air surrounding the confined spaces is at a higher pressure and hence is "drawn" into the room because of this pressure differential.*

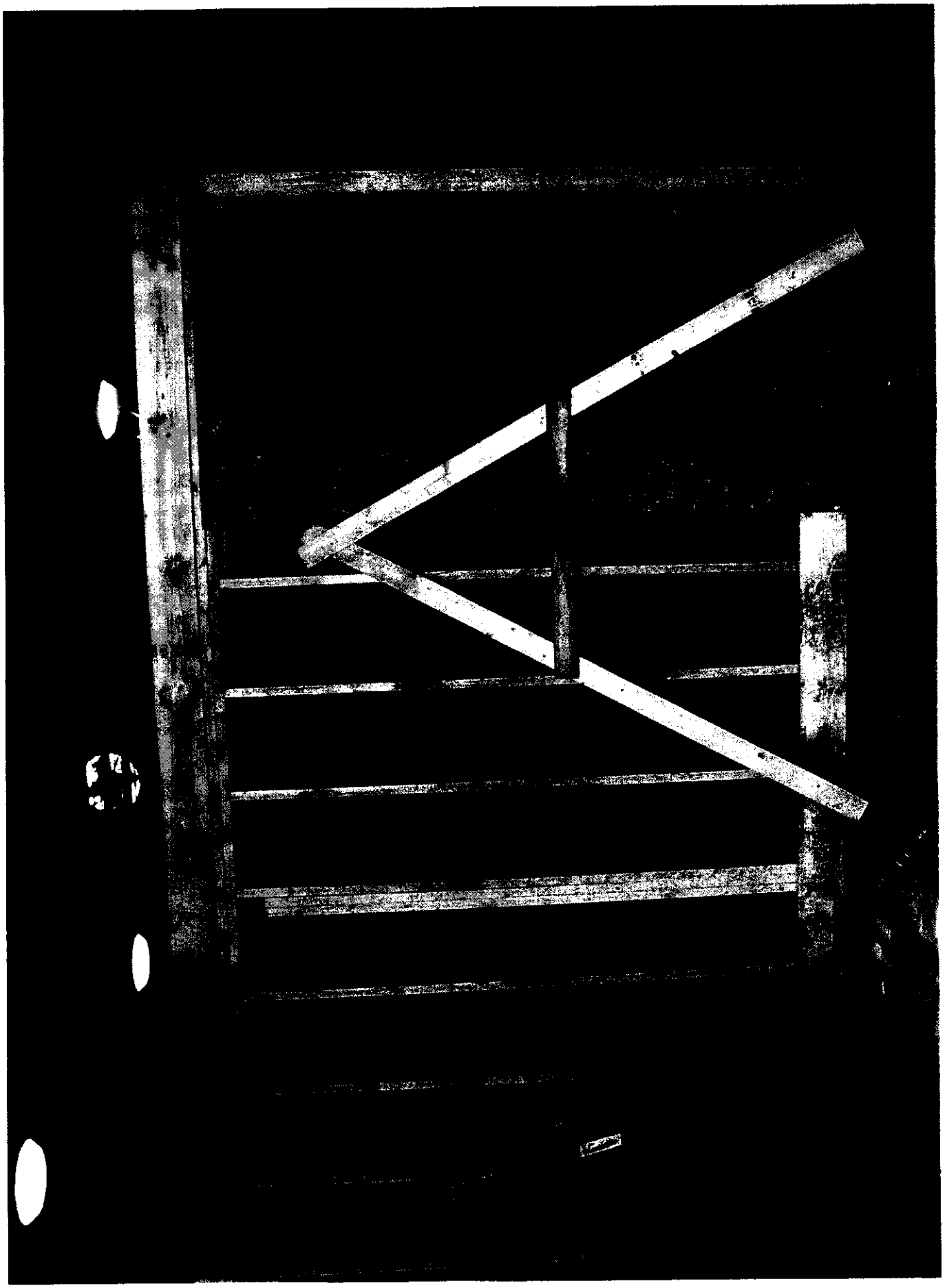
APPENDICES

APPENDIX A
Table of Test Conditions and Results,
Videotape of the Visual Effects with Smoke,
and Photographs

APPENDIX A

Table of Test Conditions and Results

TEST	TOTAL DRYER EXHAUST (CFM)	DRAFT INDUCERS	SMOKE COLOR	RESULTS
1 A	2500	Off	Blue	Smoke drawn back through water heater exhaust.
2 A	2500	On	Blue	No smoke drawn in inducers; smoke in through door cracks.
3 A	2500	On	Red	Smoke pulled out by inducers from top of water heater by draft diverter.
4 A	2500	Off	Red	Smoke drawn into room through all door cracks/seams.
1 B	1800	Off	Red	Smoke drawn back through water heater exhaust.
2 B	1800	On	Blue	No smoke drawn through water heater exhaust; smoke in through door cracks.
3 B	1800	On	White	Smoke pulled out of draft diverters by inducers.
4 B	1800	Off	Red	Smoke pulled in through all cracks/seams.
1 C	1400	Off	Blue	Smoke drawn back through water heater exhaust.
2 C	1400	On	Blue	No smoke drawn in inducers; smoke in through door cracks.
3 C	1400	On	Red	Smoke pulled out by inducers from top of water heater by draft diverter.
4 C	1400	Off	Blue	Smoke drawn into room through all door cracks/seams.



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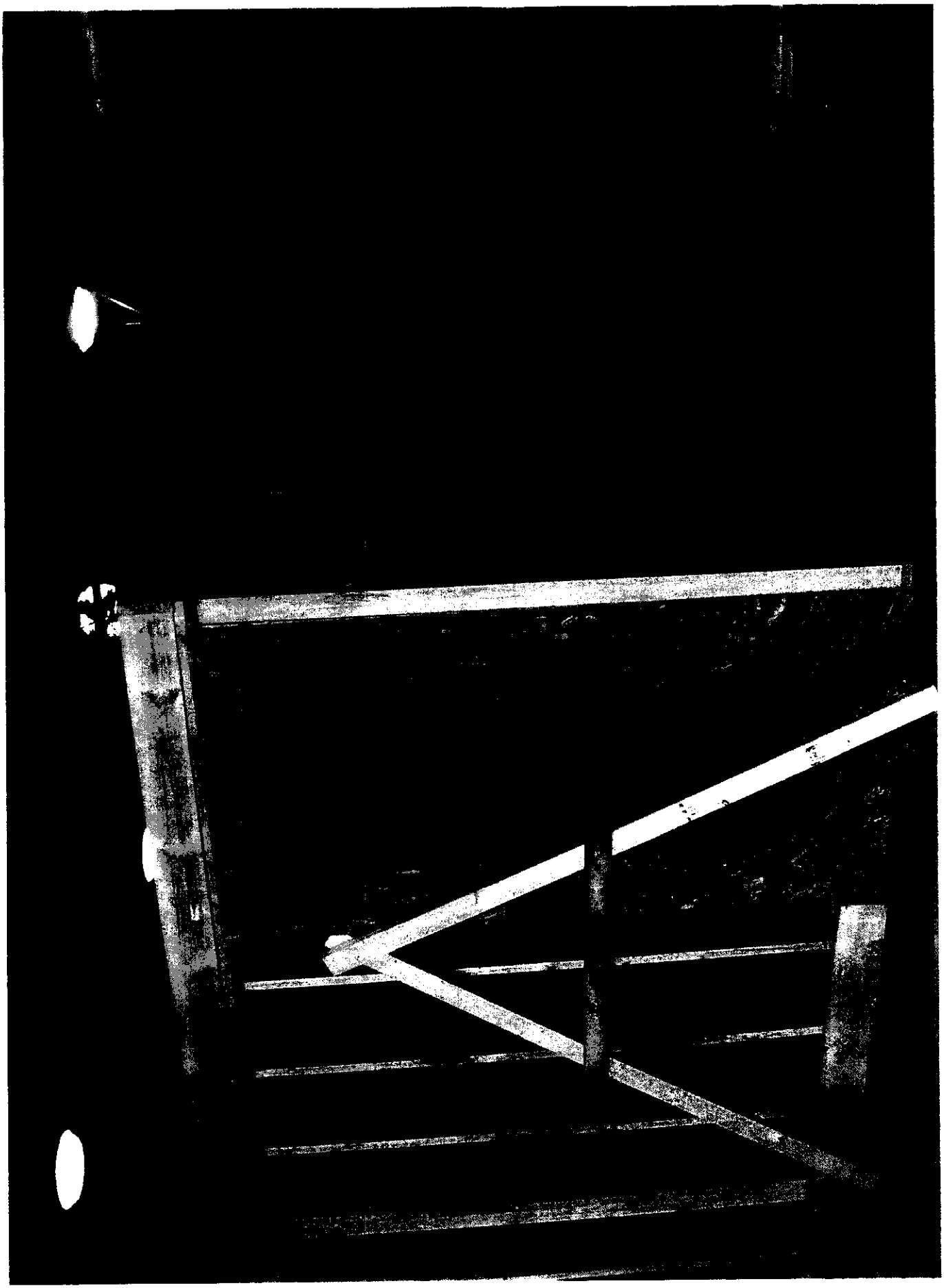

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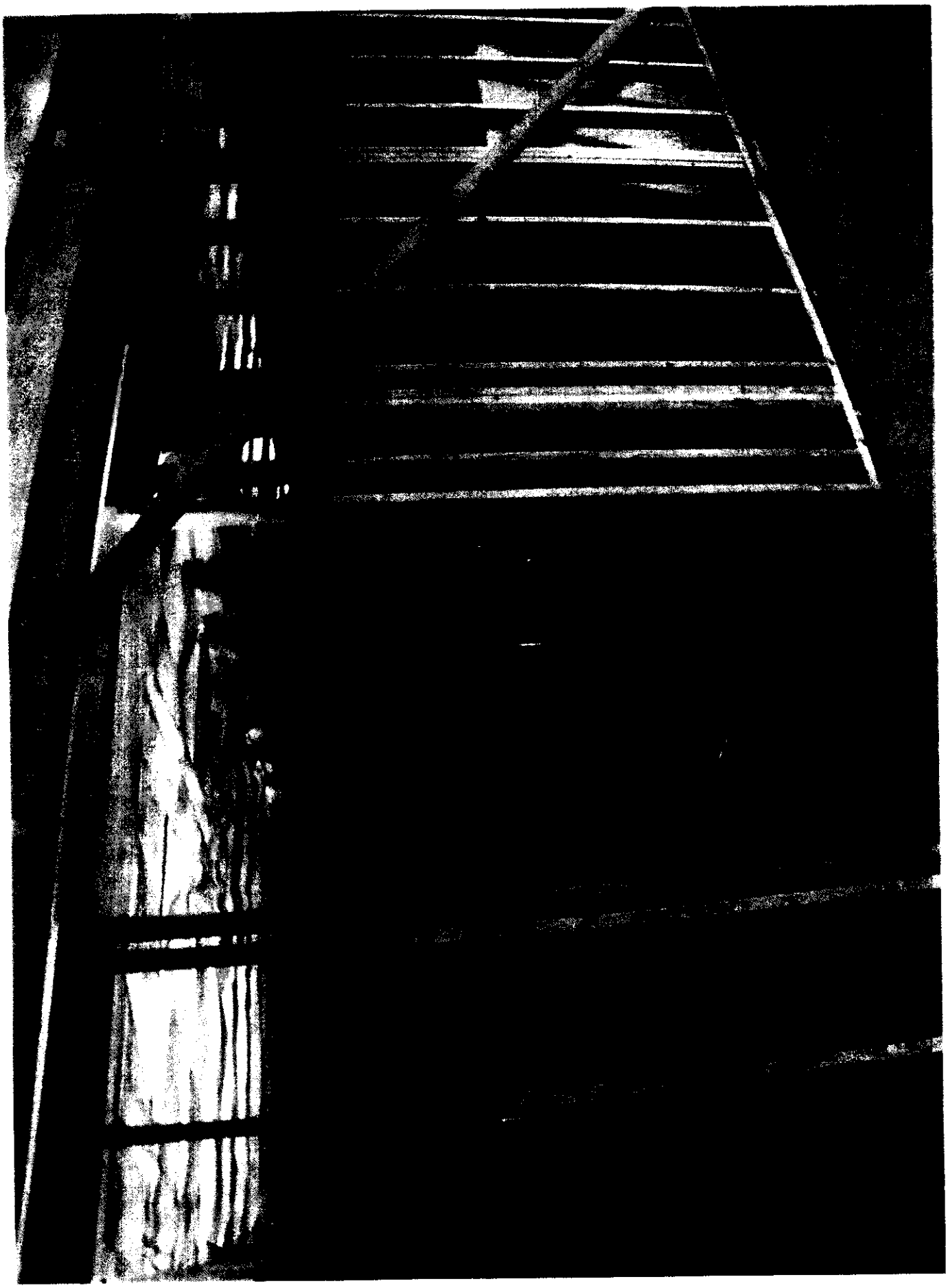

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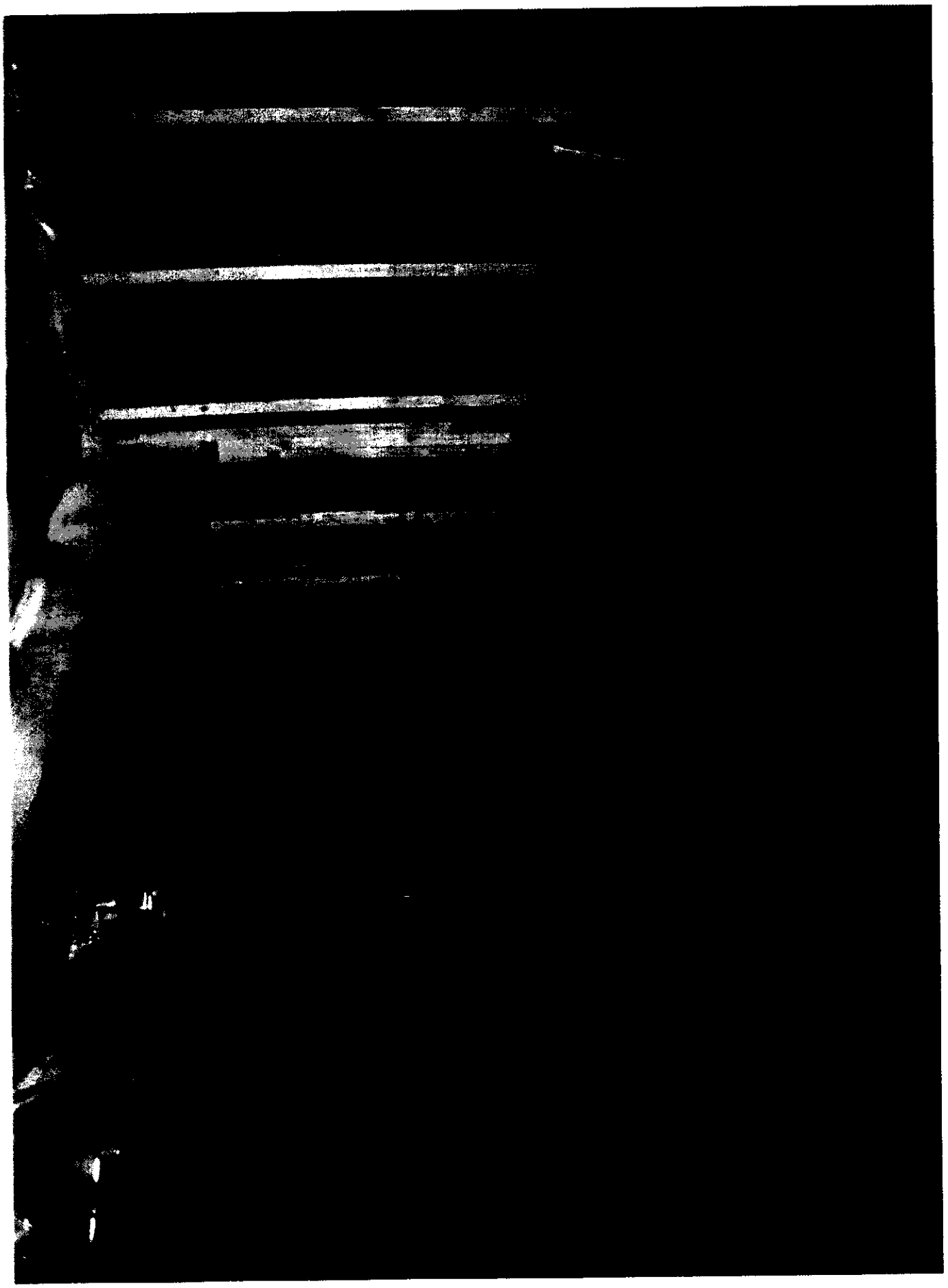

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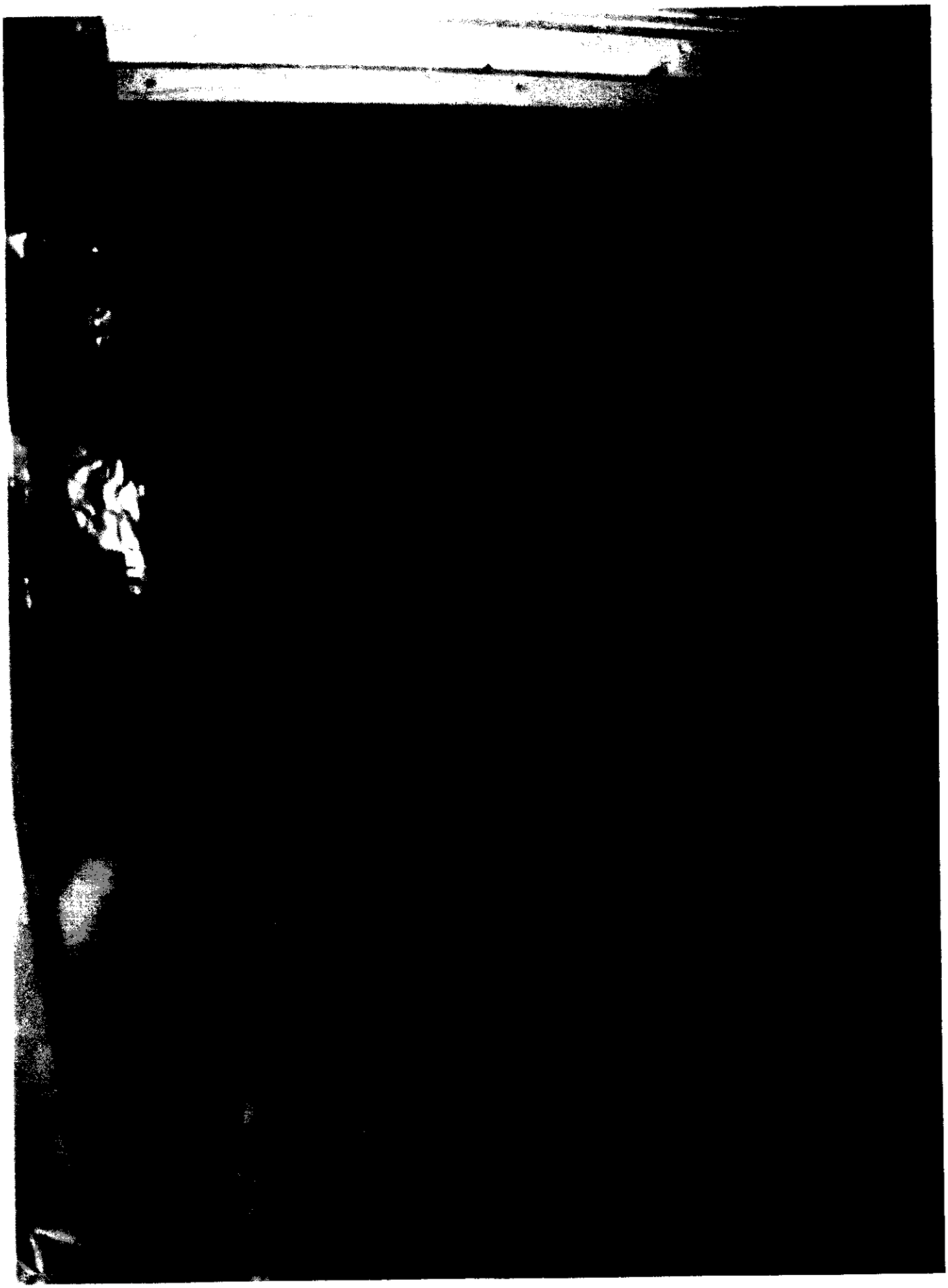

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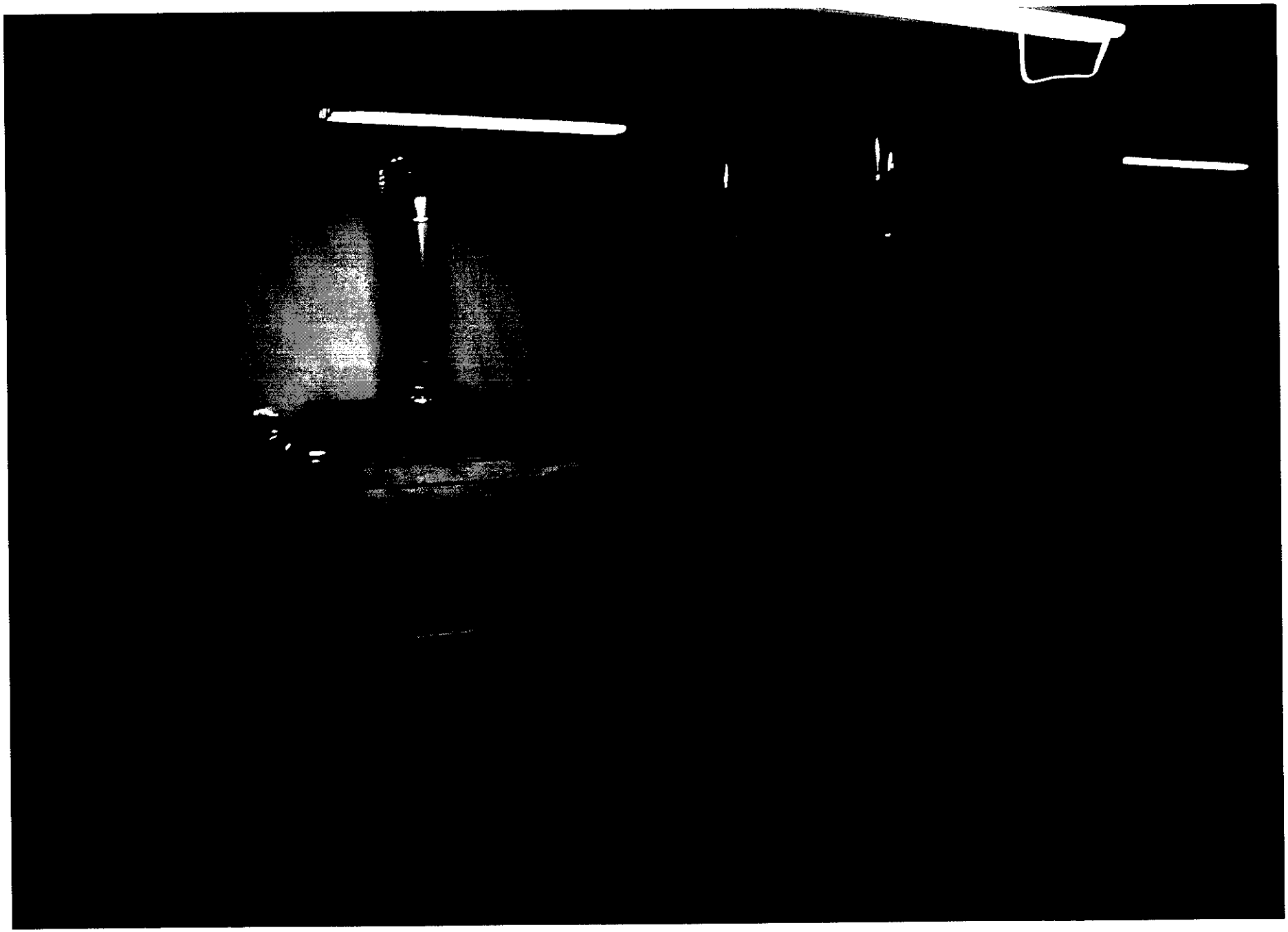

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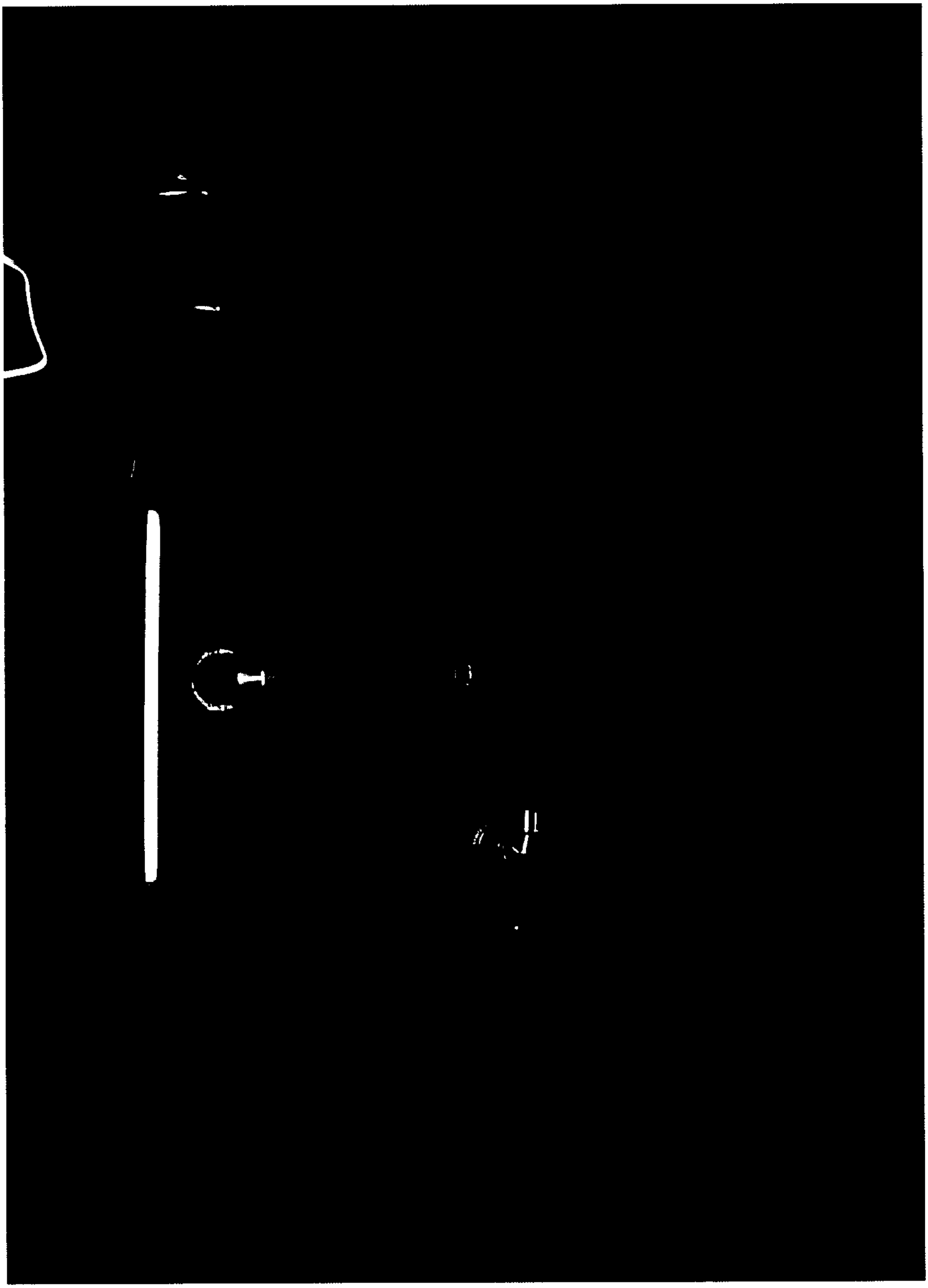

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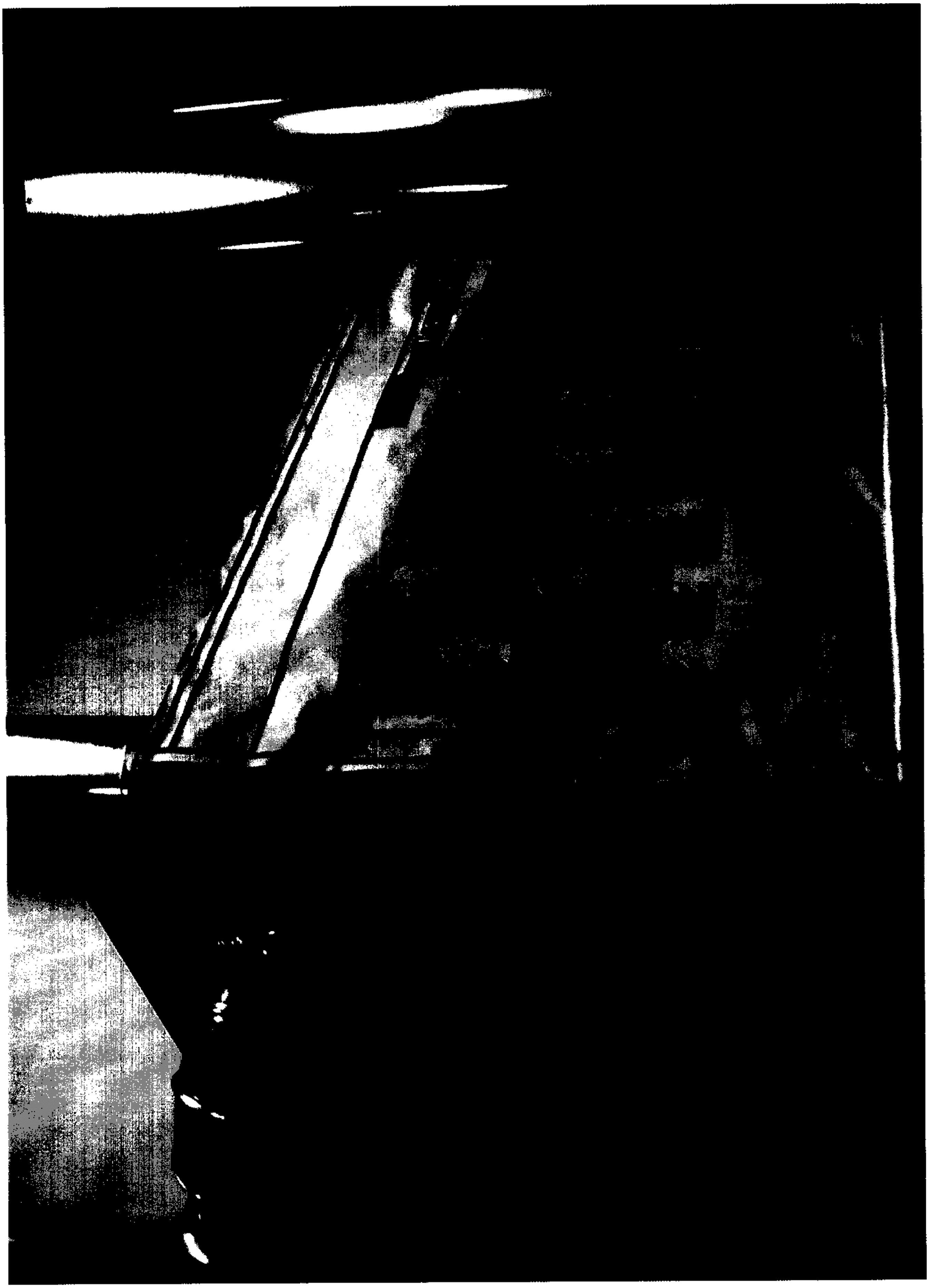

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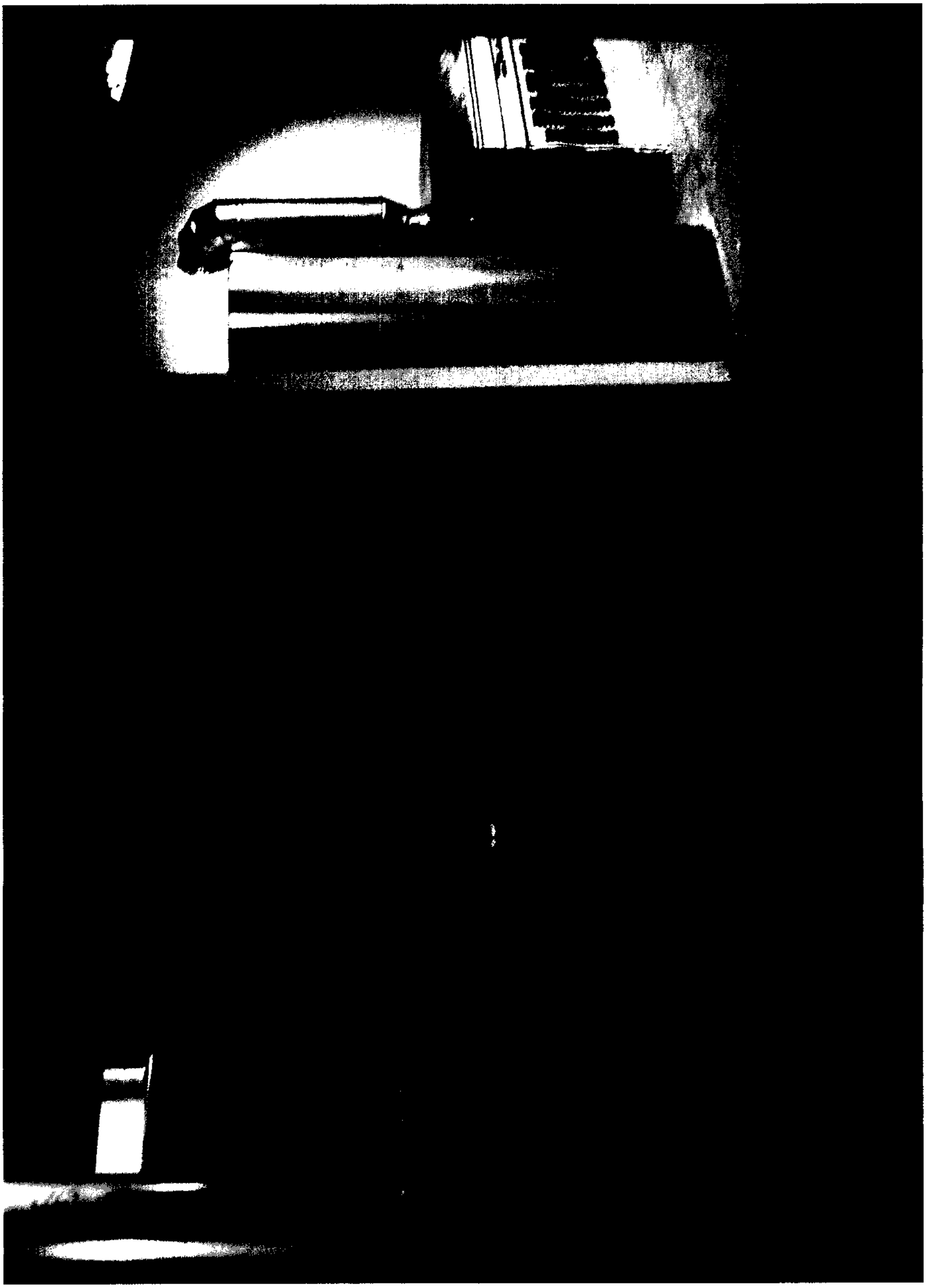

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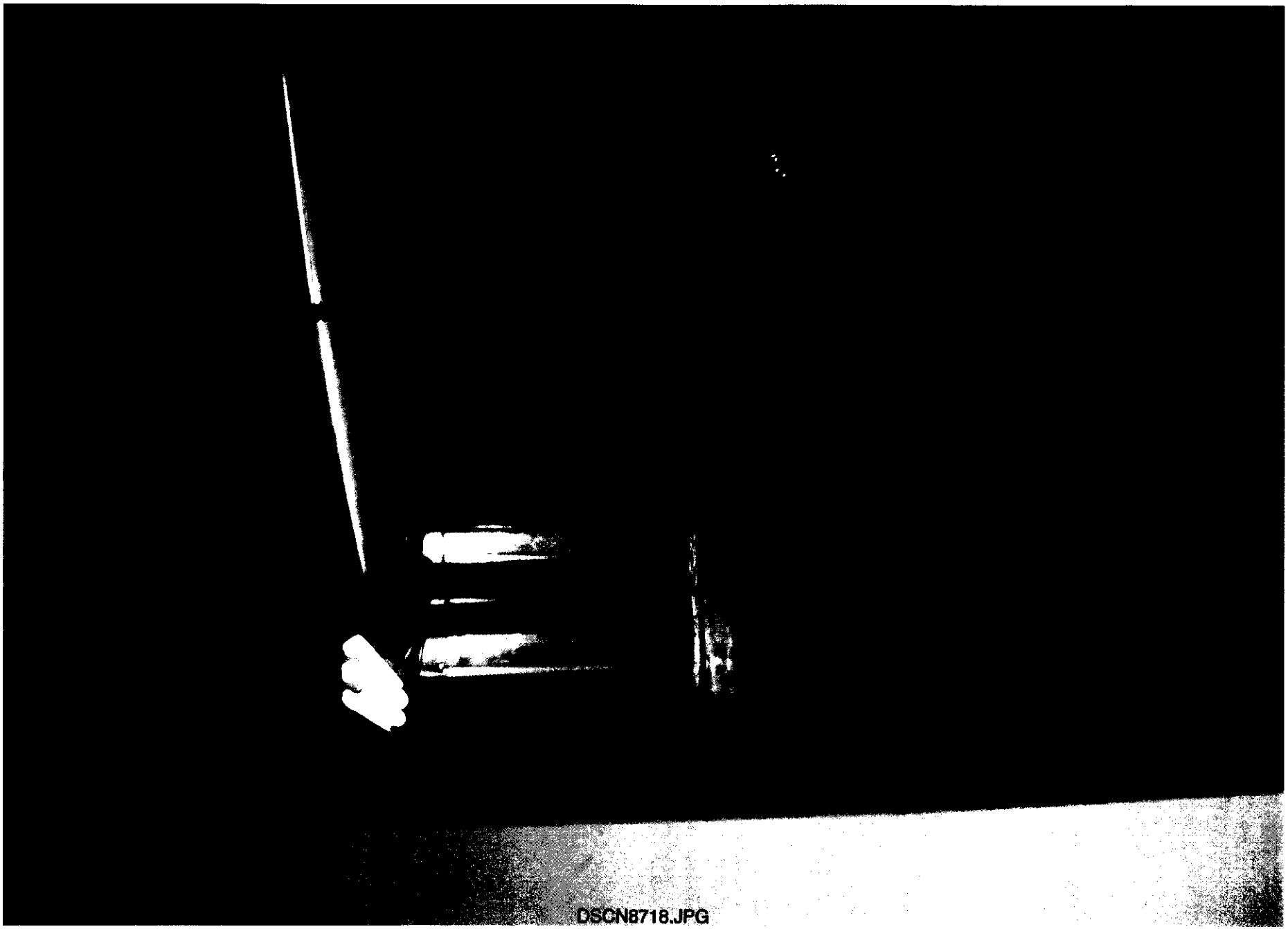
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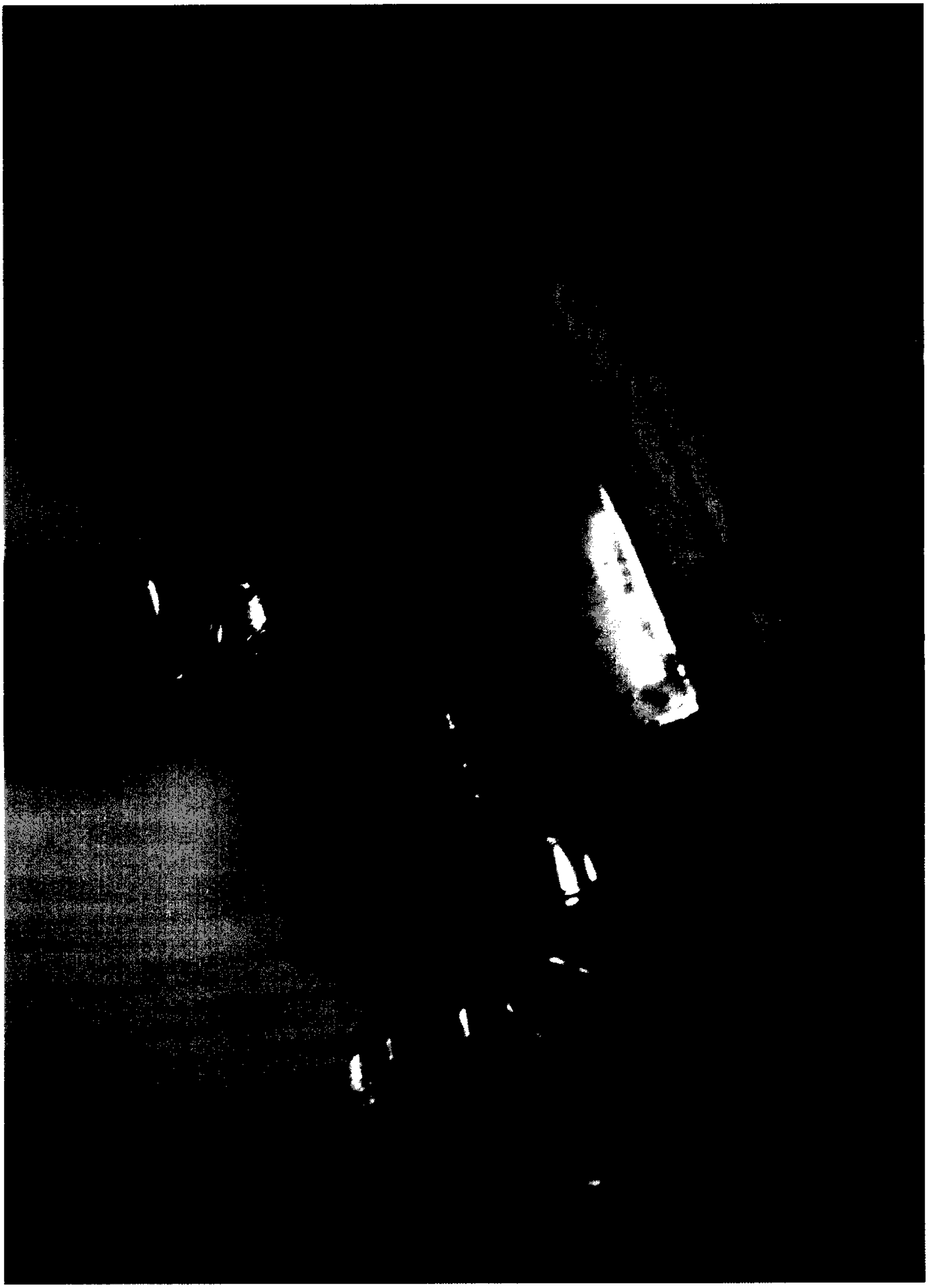

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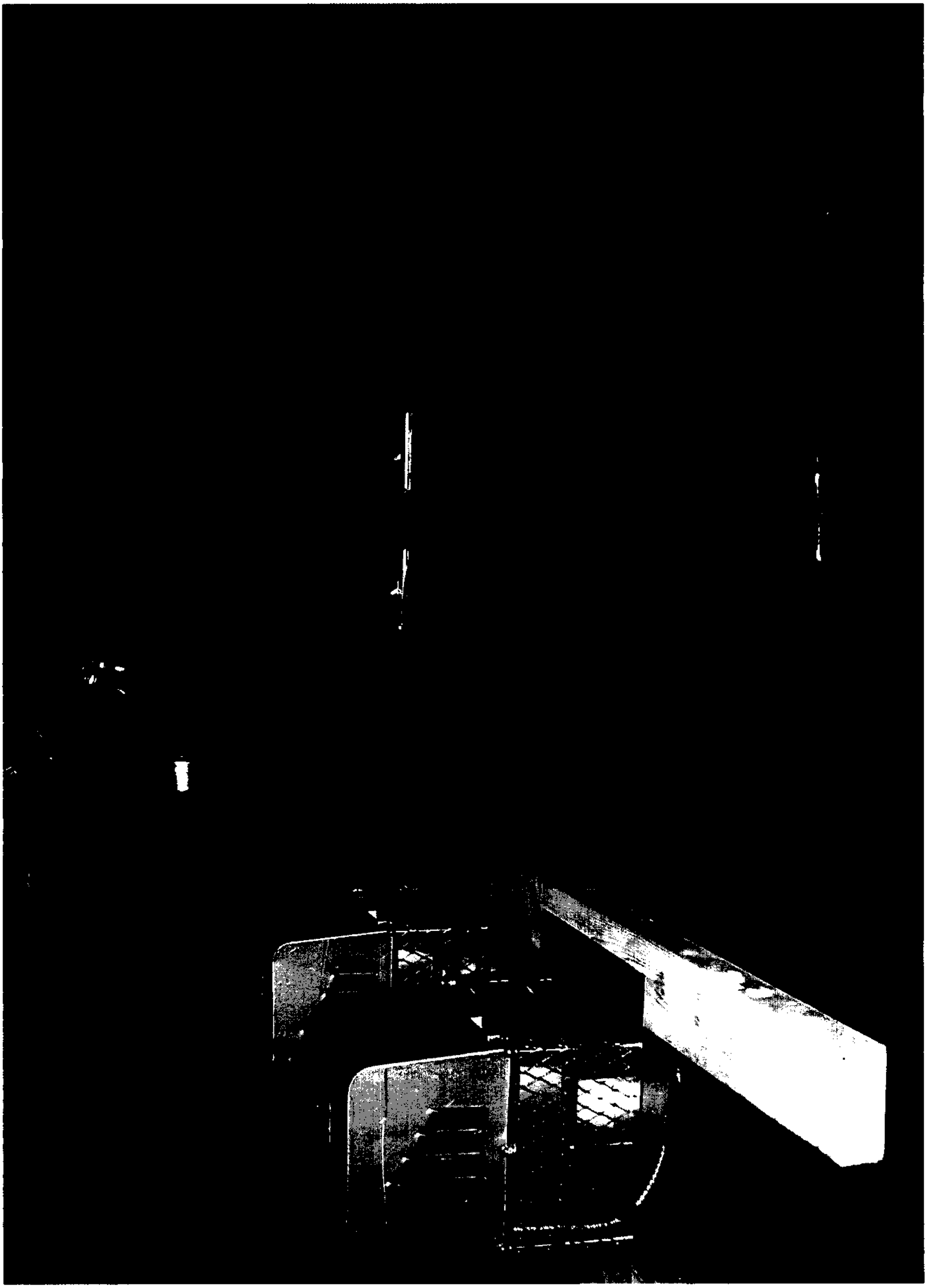

Williams, Randy (Exemplar)

APPENDIX B
Videotape of the Accident Reconstruction Animation